Onboard Navigation System in a User Receiver

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Onboard Navigation System in a User Receiver

Objective and Significance

GSFC

Overall Objective

Reduce the cost of autonomous onboard navigation implementation and testing for ground station or small satellites requiring autonomous nav.

Goals	Significance
#1: Develop ground station receiver Doppler extractor, synchronization circuit, and design for the Navigation Processor Board	• Developing an integrated ONS in the receiver based on EOS-AM1 TONS flight software eliminates software development cost and risk for future ONS users. As spacecraft size decrease and the need to reduce ground operations (and associated costs) increases, more missions are investigating autonomous service options, especially in navigation. An integrated tested navigation system, which can be procured as an option ($125K) to the existing spacecraft communications equipment will be significantly cheaper and more reliable than independent software development ($>1M) and system integration efforts ($.2M).
#2: Fly communications receiver w/integrated ONS	• Flight demonstration qualifies the system for future users in the competitive marketplace.
#3: Assess feasibility and capability of one-way crosslink tracking for formation flying	• Enhance autonomous formation flying by performing spacecraft-to-spacecraft tracking and relative navigation processing onboard.

Onboard Navigation System in a User Receiver

Products and Customers

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Product	Goal #	User/Customer	Development Phase: Concept	Design	Demo	Transfer	Approach/Comments
System & Ops Concept	1	Future mission	■				
Requirements	1		■				
Math Specs	1		■				
Doppler Extractor Spec.	1			■			
Doppler Extractor S/W	1			■			
Synchronization Circuit	1			■			
Nav Processor Bd. Design	1			■			
Interface Definition	1			■			
GONS Analysis w/TCXO	2				■		
Flight Agreement	2				■		
Crosslink Meas. Model	3		■				
Crosslink Data Simulation	3		■				
Crosslink Analysis	3		■				

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FY97 Goals

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- Complete Navigation Processor Board Design (Goal #1)
- Complete Integrated ONS Interfaces Definition (Goal #1)
- Publish Analysis Results of GONS with a TCXO (Goal #2)
- Crosslink Analysis for EO-1 to support formation flying (Goal #3)

Onboard Navigation System in a User Receiver

FY97 Accomplishments

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- Developed measurement model for spacecraft-to-spacecraft crosslink (Goal #3)
- Modified Simulation Tool with crosslink measurement model (Goal #3)
- Modified Prototype algorithms with crosslink maesurment model (Goal #3)
- Completed EO-1 to Landsat-7 crosslink relative navigation analysis (Goal #3)
- Transitioned navigation processor board design over to TDRSS Fourth Generation Transponder (Goal #1)
- Submitted technical paper on GONS with a TCXO (Goal #2)

Onboard Navigation System in a User Receiver

FY97 Accomplishments

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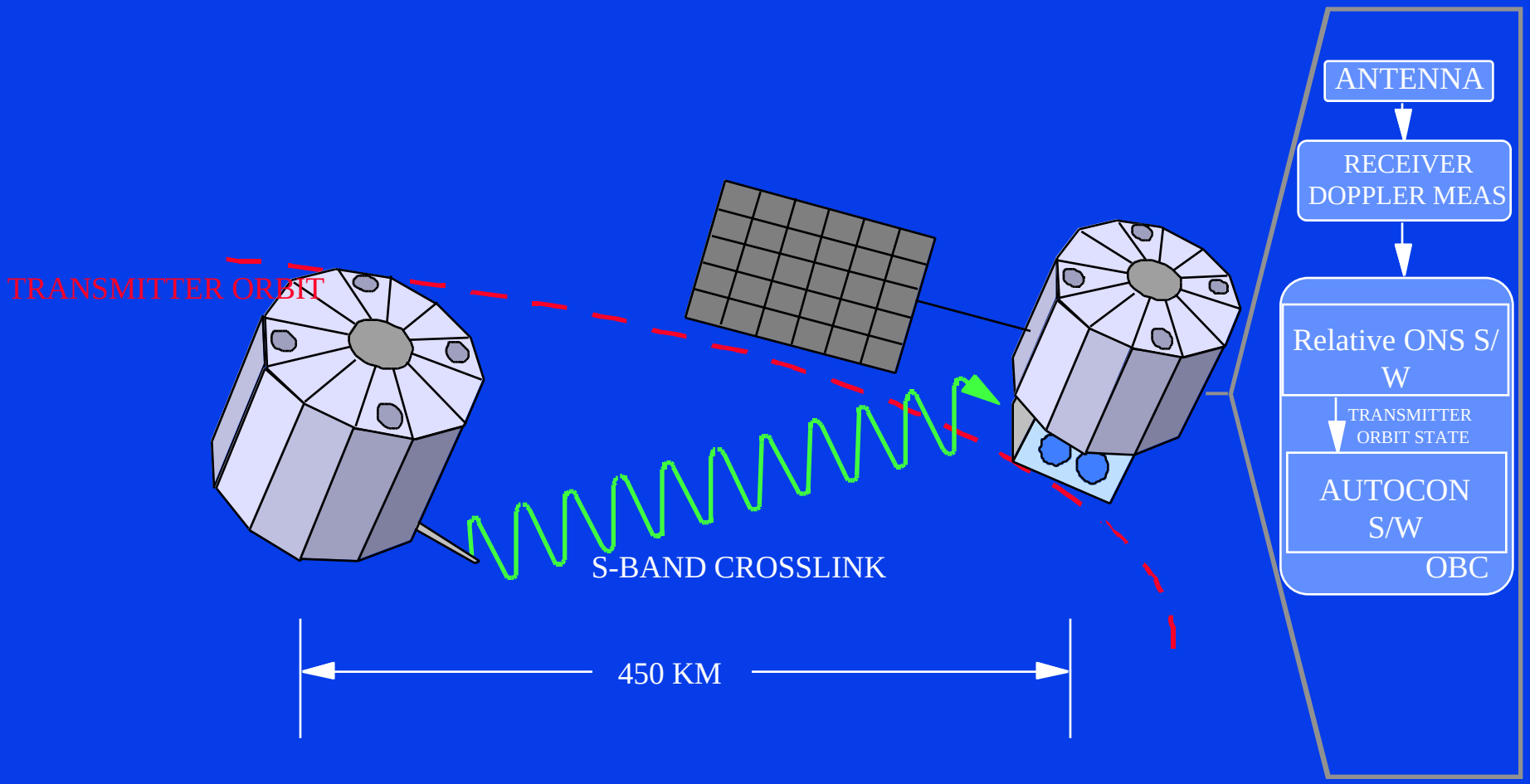
LANDSAT-7 to EO-1 CROSSLINK RELATIVE NAVIGATION



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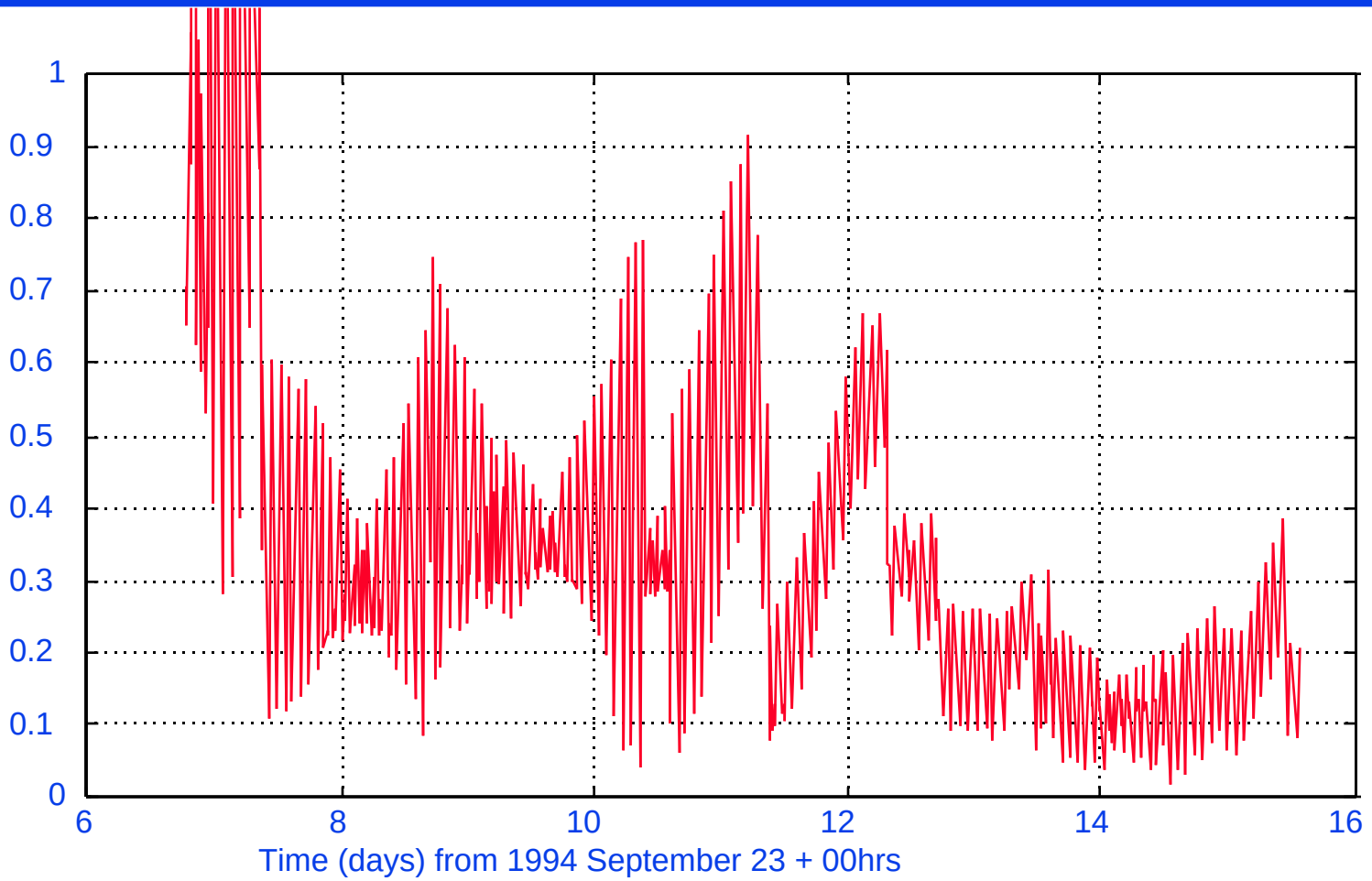
FY96 Accomplishments (Cont'd)

EPHEMERIS COMPARISON GONS W/TCXO v. TDRSS



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Schedule

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Task	FY96				FY97				FY98		FY99	FY00	FY01	FY02
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1/2	Q3/4				
Develop concept, requirements, & specs														
System Concept s & Reqmnts(Goal #1)														
Doppler extractor specs (Goal #1)														
Mathematical specs (Goal #1)														
Interface Definition (Goal #1)														
Command Receiver Development														
Doppler Extractor developed (Goal #1)														
Synchronization Circuit (Goal #1)														
Nav Processor Board Design (Goal #1)														
Software Development (Goal #1)														
Flight Demo														
GONS w/TCXO analysis (Goal #2)														
Fligt Agreement (Goal #2)														
Crosslink Relative Nav. Analysis (Goal#3)														
Resources by FY ($K):		100				100								

Testing Complete

Critical Design

Fab

I&T FSW

Paper

Verbal Agreement

Continued Analysis